

# Human Factors Issues in U.S. Army Shadow UAV System



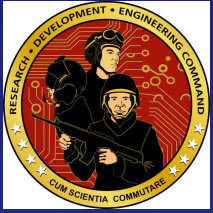
**Susan R. Dowell**

**U.S. Army Aeroflightdynamics Directorate**

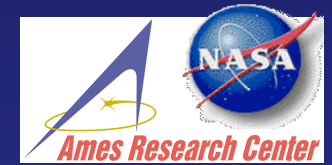
**Army/NASA Rotorcraft Division**

**Moffett Field, CA**

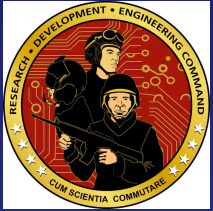
**NASA Human Factors Symposium ♦ October 20, 2004**



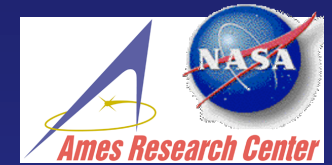
# Outline



- U.S. Army UAV Operators (96U MOS)
  - Demographics
  - Operator Training
- Shadow Tactical UAV
  - Current Interface
  - Identified Human Factors Issues
- HF Research Conducted by HSI group
- Current Research
- Future Goals for UAV operations

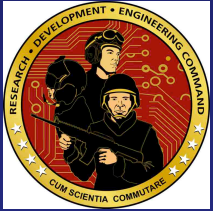


# Why UAVs?

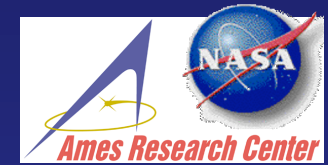


[In response to a recent shutdown incident in Fallujah...]  
*"A piece of fiberglass and aluminum held up in front of a camera is just not the same as a U.S. soldier or pilot."*

Dyke Weatherington  
UAV Task Planning Force, Pentagon

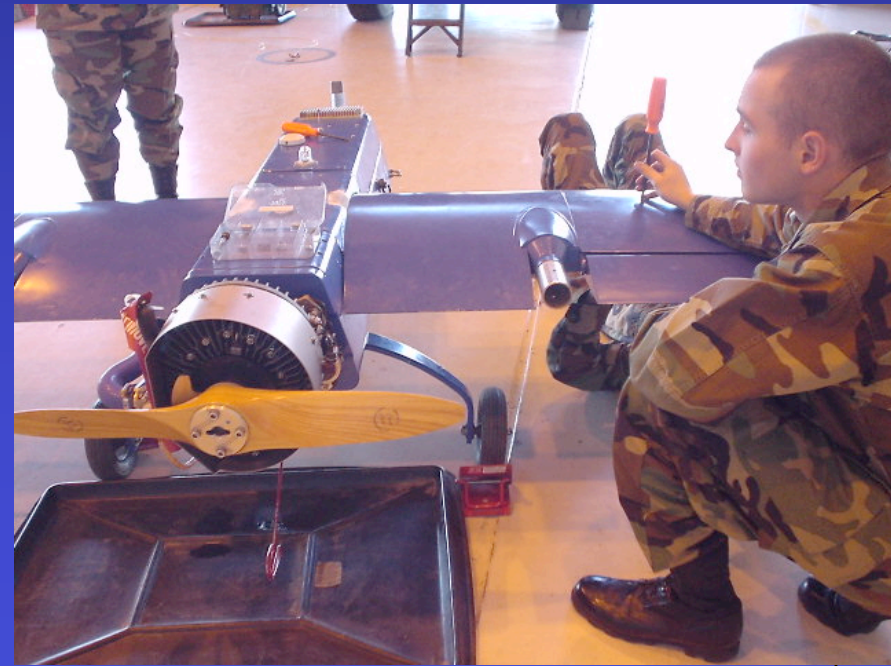


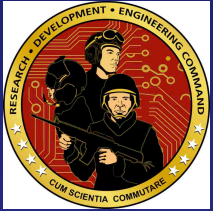
# Army UAV Operator: 96U MOS



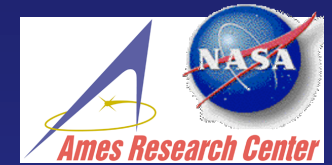
- 18 - 23 years old
- Top 5% ASVAB scores

- Some have college degrees
- Secret security clearance
- Attrition = 30%
- Must pass flight physical

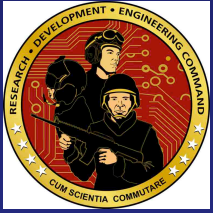




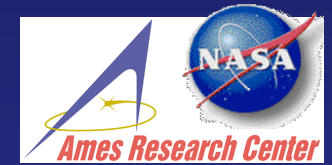
# Major Duties of UAV Operator



- **Supervises and Operates UAV**
  - Mission planning
  - Launch and recovery
  - Remotely piloting
  - Mission sensor/payload operations
  - Tactical ID
  - Minor air frame repair

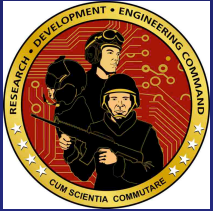


# Operator Training: Ft. Huachuca, AZ

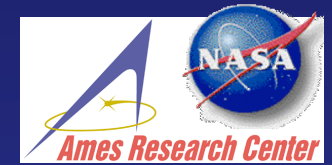


## 23 Week Course:

- Private Pilot Ground School
- Flight Line Operations
- Intelligence Common Core (Tactical ID)
- Payload Operator Classroom
- Vehicle Operator Classroom
- Simulator Training
- Preflight/Engine Start Lab
- Flight Training



# Shadow 200 TUAV



**Intell, search, recon missions**

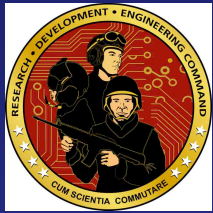
**Mission duration 4hrs.**

**Max. altitude 14,000 ft. MSL**

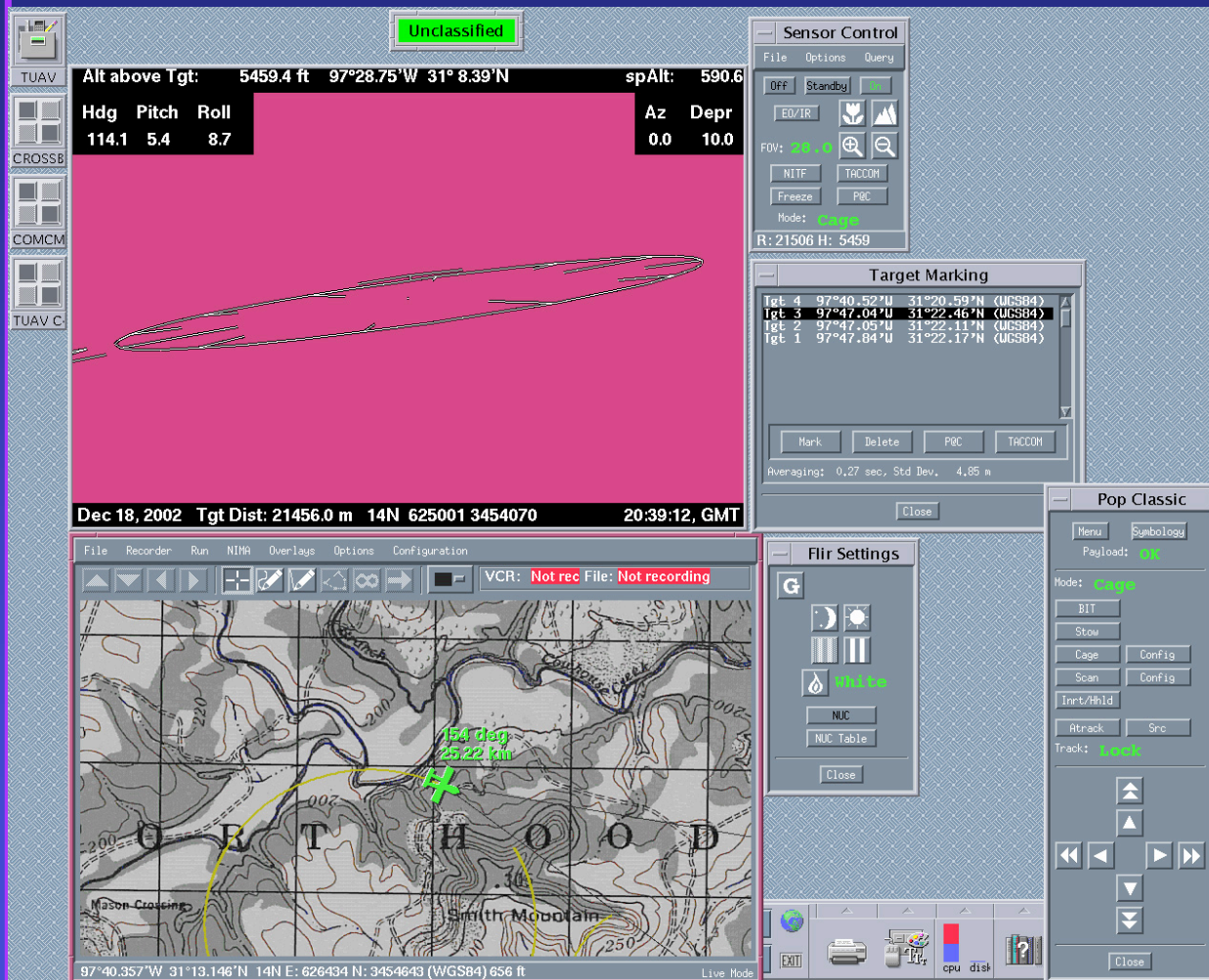
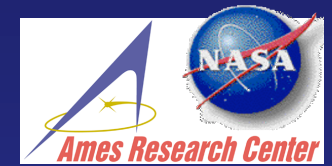
**Endurance speed: 65-85 knts**

**Cost = \$250,000 with payload  
\$1M**

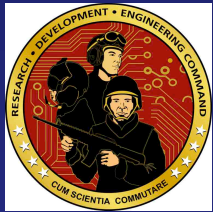
- ✓ Over 10,000 flight hours in Operation Iraqi Freedom
- ✓ Approaching 2500 flight hours/mo. in the theater
- ✓ DoD will spend \$2.2B on UAVs in FY 05



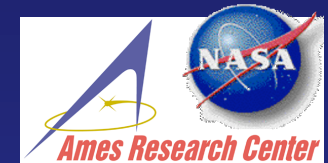
# Mission Planning: Payload Operator Display



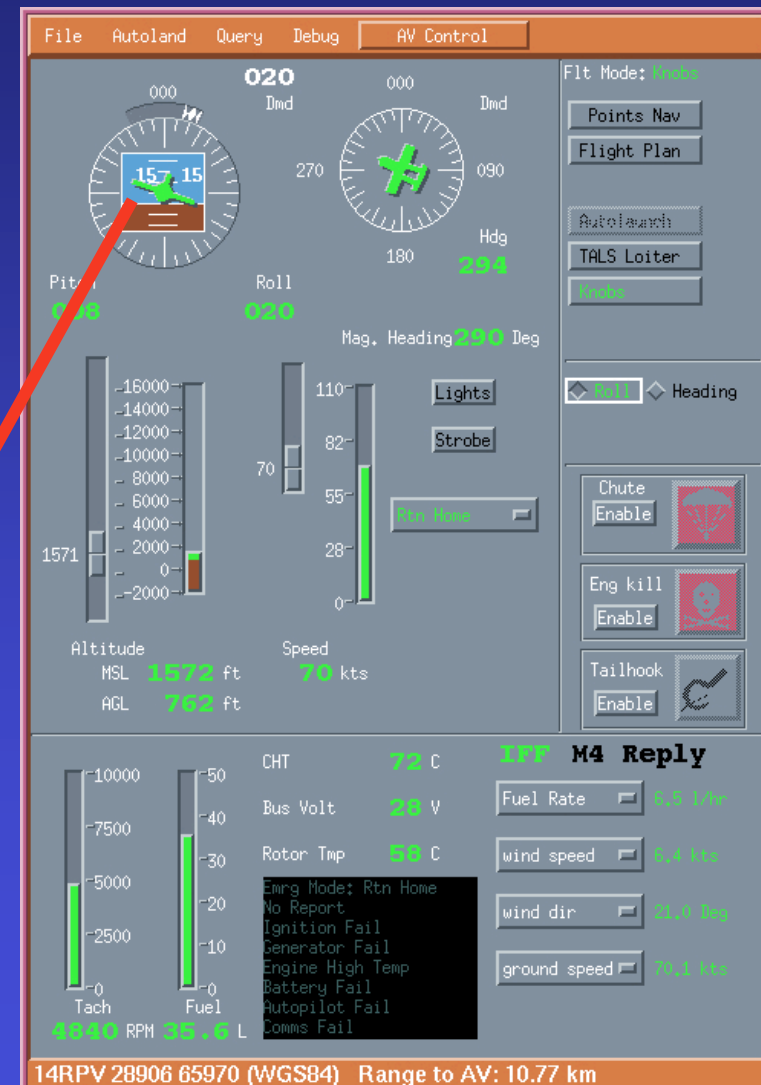
- Video feed with selected payload overlays
- Manipulation of payload (GUI/joystick)
- Icons borrowed from digital camera design
- North up map
- Threat/target overlays design much like drawing tools in Microsoft

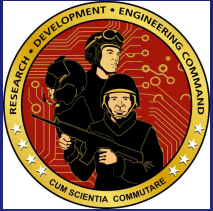


# AVO Display: AV Control Panel

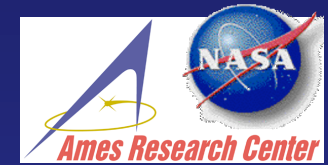


- Preset waypoint missions interrupted 90% of the time
- Attitude Indicator - pitch/roll, artificial horizon
- Operator can only command heading, roll, speed, altitude (slider bars)
- Values will turn **orange** if lose comm with AV

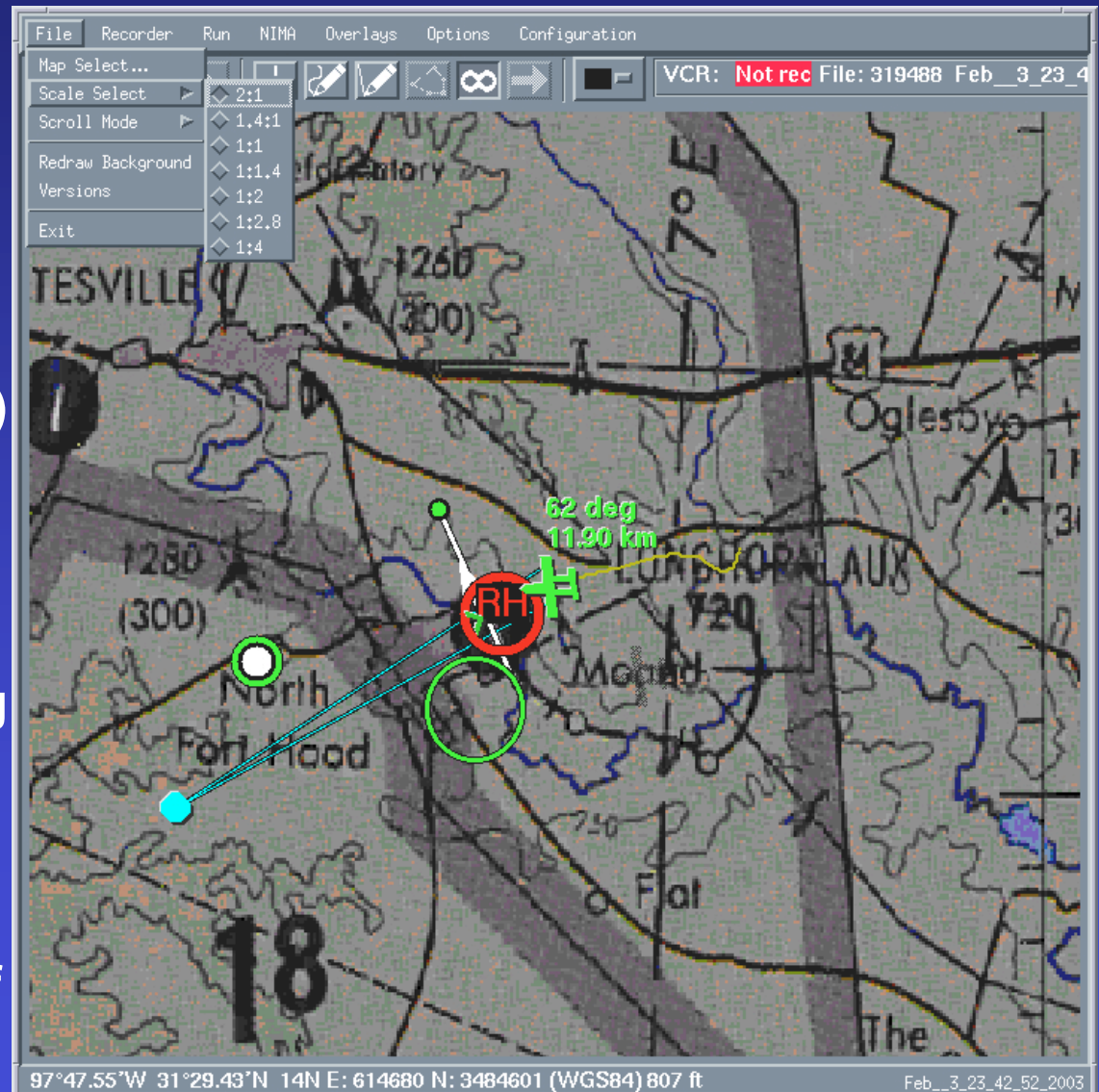


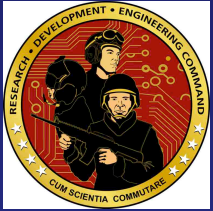


# UAV GCS Interface Challenges

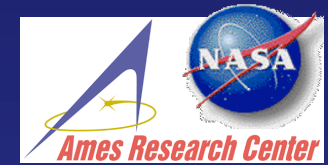


- **Hardware**
  - Keyboard feedback
  - Joystick
- **Display Menus**
  - Architecture (depth)
  - Organization
  - Size- (Fitt's Law)
- **Mode Awareness**
  - Dynamic Re-tasking
- **North up map**
- **Correlating map to video image**
- **TALS landing waive off**

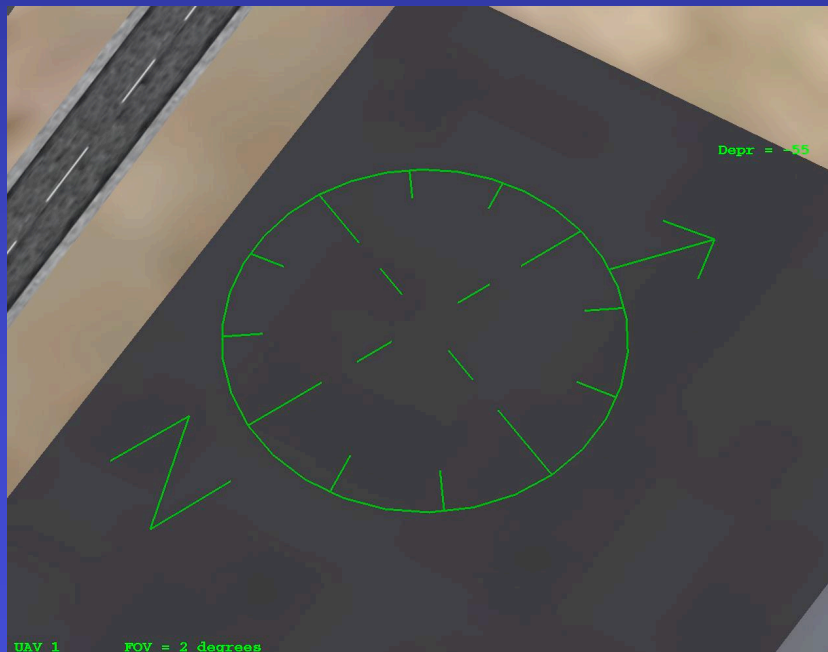




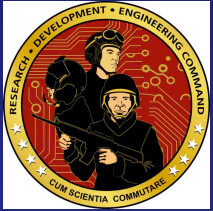
# HSI UAV Research



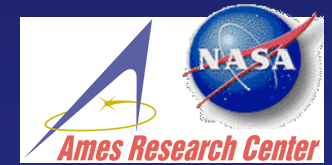
- Payload symbology assessment
  - Baseline compass rose vs. heading tape



Funded by Army S & T performed in the joint Army/NASA Rotorcraft Division 11



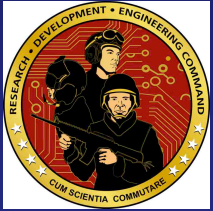
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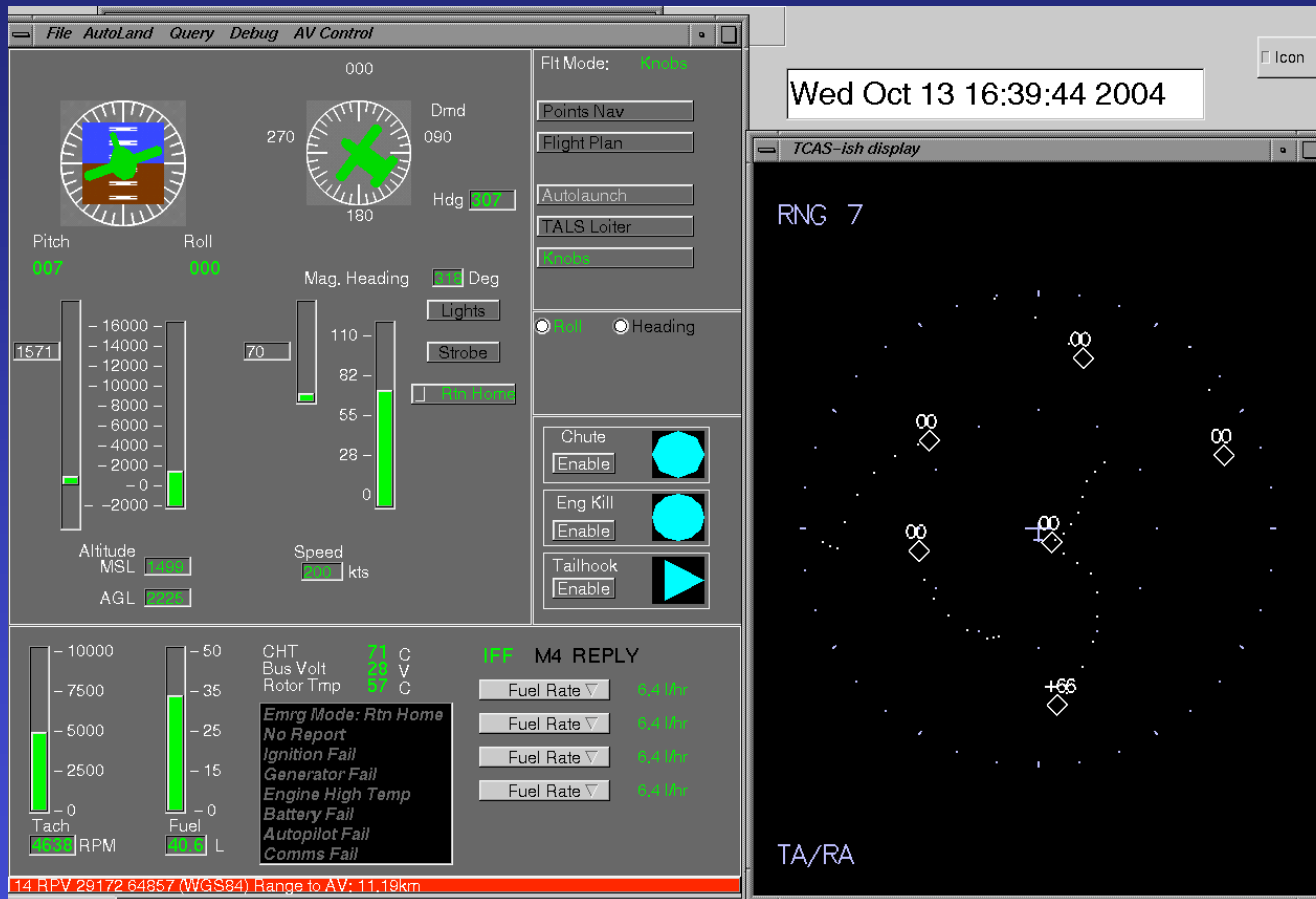
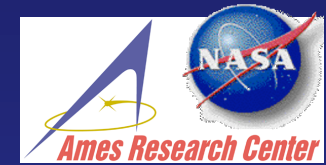
- HMD utilized for sensor control and video display
  - Head-slaved sensor
- 3-D audio vs. stereo vs. mono alerting for ground targets



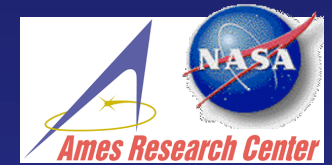
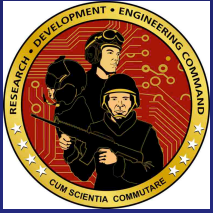
Funded by Army S & T performed in the joint Army/NASA Rotorcraft Division<sup>13</sup>



# HSI UAV Research



- T-CAS like display for UAVs operating in unrestricted airspace



# Ongoing Research

## Multi-modal Advanced Interfaces

### Levels of Automation

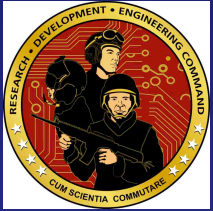
- Supervisory control and re-entering the control loop

### Man-Unmanned Teaming

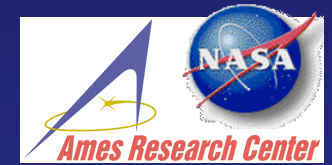
- Controlling UAV from Apache Longbow
- VMS entry in Summer '05

### Safely Operating UAVs in the NAS



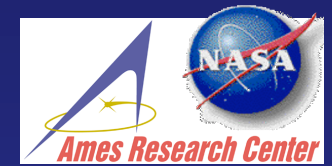
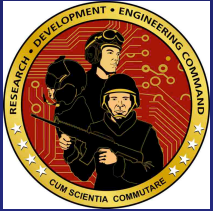


# Future Goals



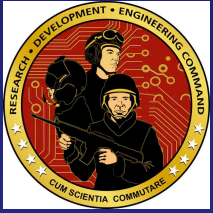
- Single operator controlling multiple heterogeneous UAVs
- Common operator interface (400 in the field today!!)
- Portable, intuitive interface for dismounted soldiers and small UAVs
- Advanced interface designs for increased SA and reduced workload (imagery analysis)



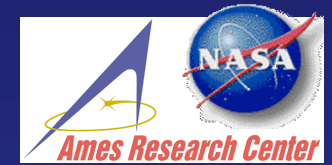


# Questions?





## Did you know...



- Baby wipes are used to clean dusty UAV engines in “sandy places”
- Fuel bladders filled to capacity will expand and explode in severe desert heat
- Mis-keying coordinates has caused UAVs to fly to the wrong hemisphere
- GCS touchscreens were eliminated because moths were flying into the display and activating functions
- One shutdown incident was first discovered by the payload operator seeing gas leak across the camera lens